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## (54) Apparatus for securely storing sheet material e.g. banknotes

(57) Apparatus for securely storing sheet material is disclosed which comprises a housing with an entry opening to receive and admit a sheet of material such as a banknote, to the interior thereof. A secure storage cassette (50) which receives and stores notes admitted to the housing has a tortuous opening (51) through which a banknote (16) is pushed by a note inserter (11). The shape of the note inserter (11) is the same as that of the tortuous slot (51) so that when a note (16) is admitted to the housing and it arrives in front of the tortuous opening (51) in the cassette (50), the inserter (11) moves towards said opening (51) to fold the note (16) and push it into the interior of the cassette.

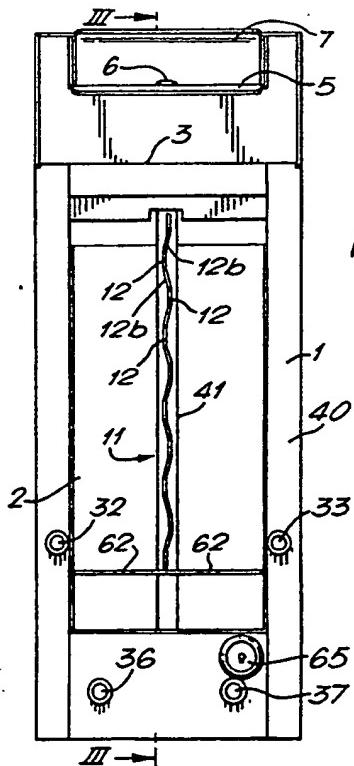


FIG.2.

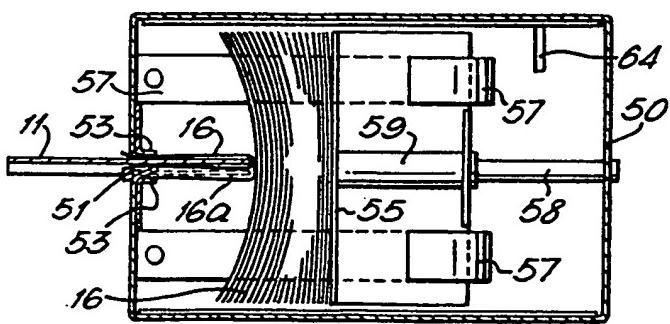


FIG.5C.

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At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

GB 2 236 143 A

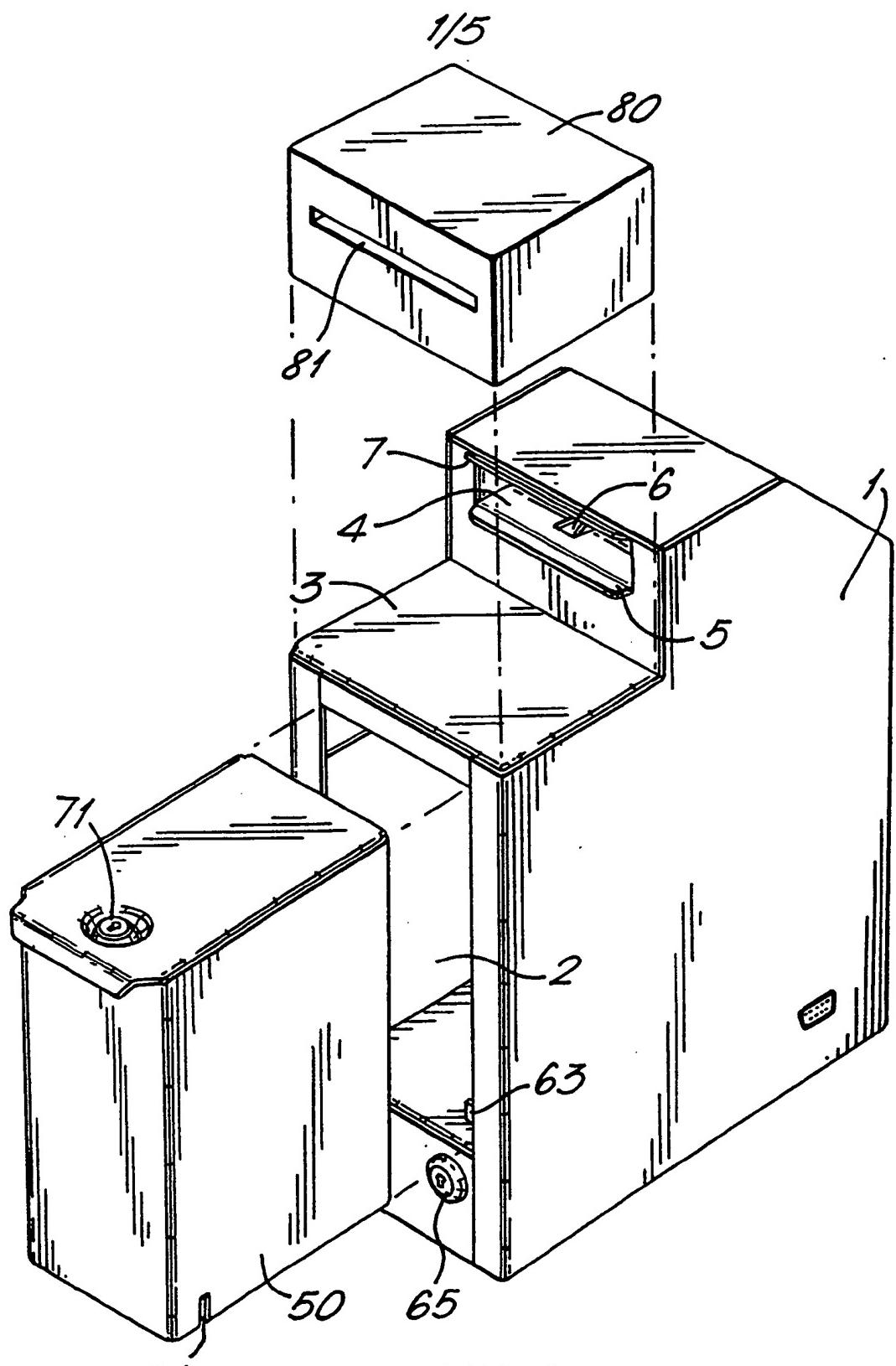


FIG. 1.

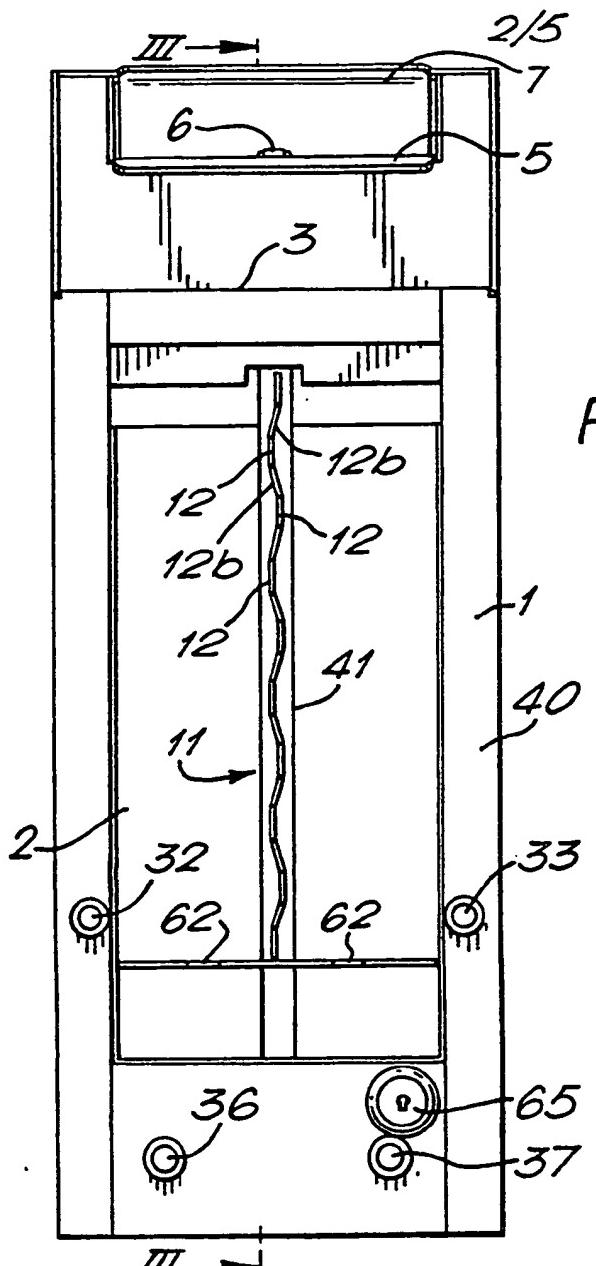


FIG. 2.

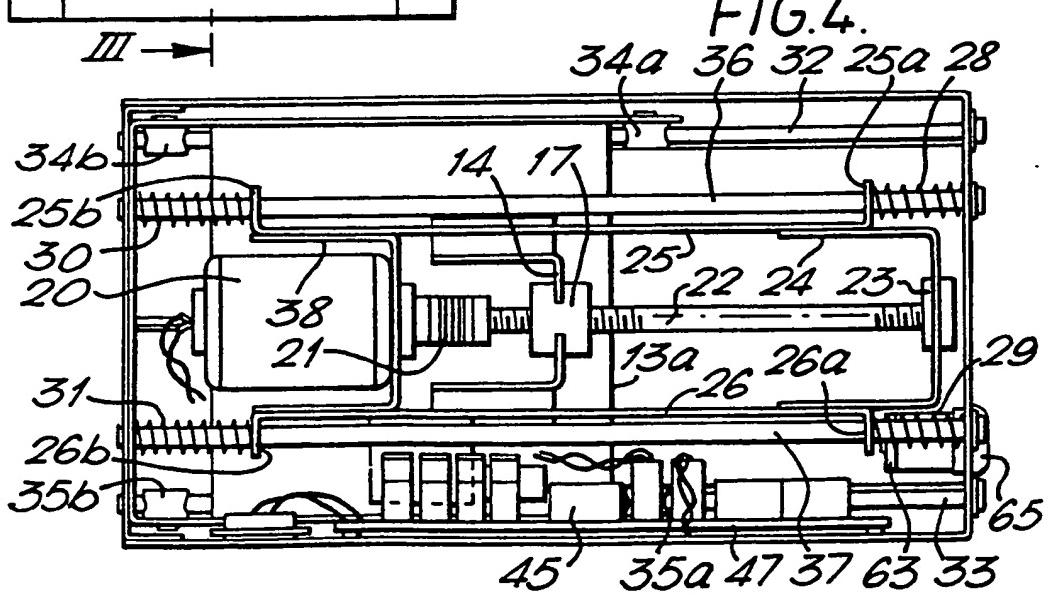
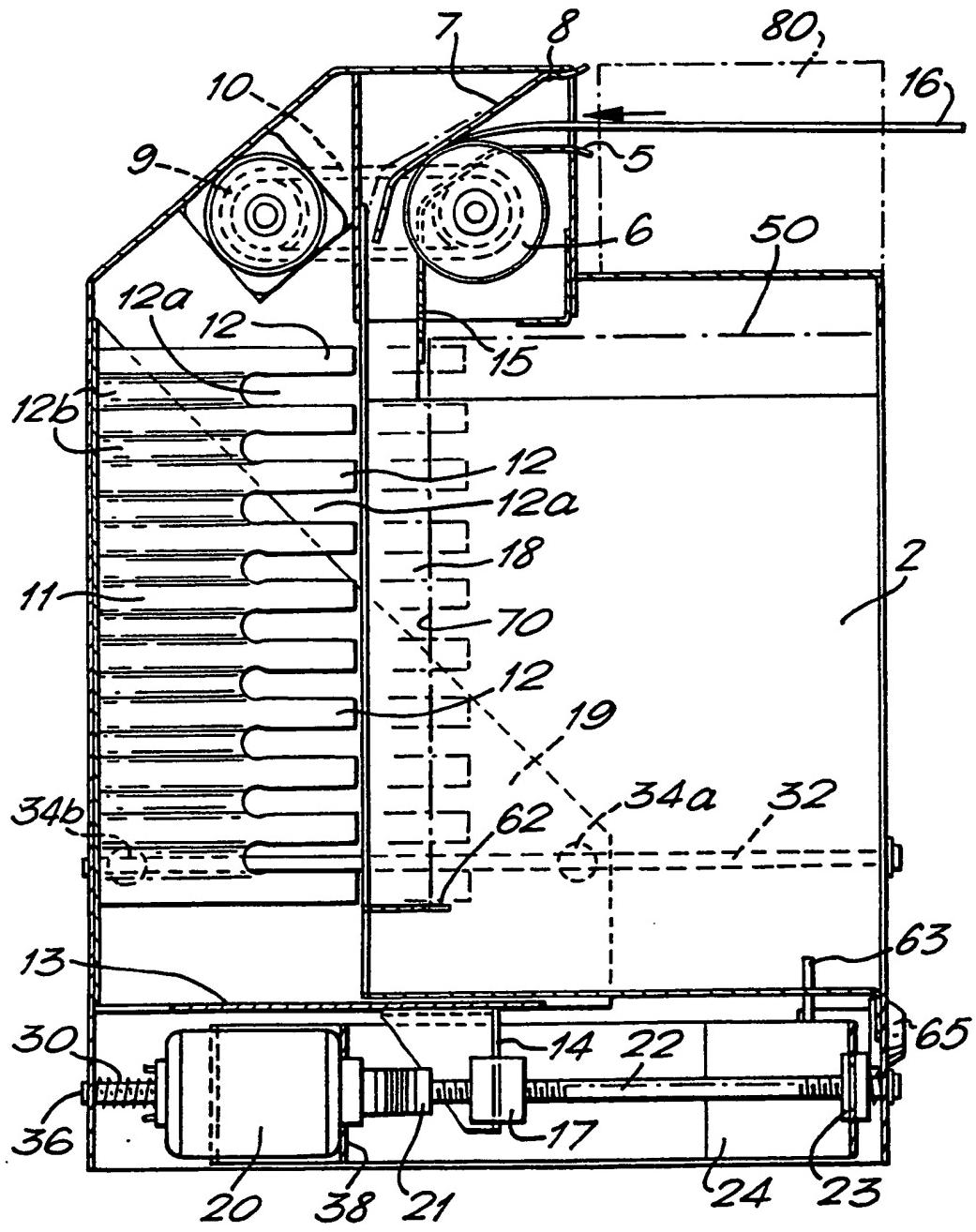


FIG. 4.

3/5

FIG. 3.



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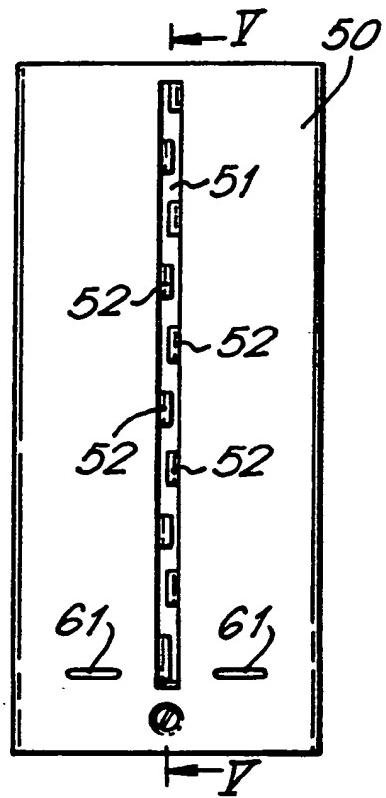
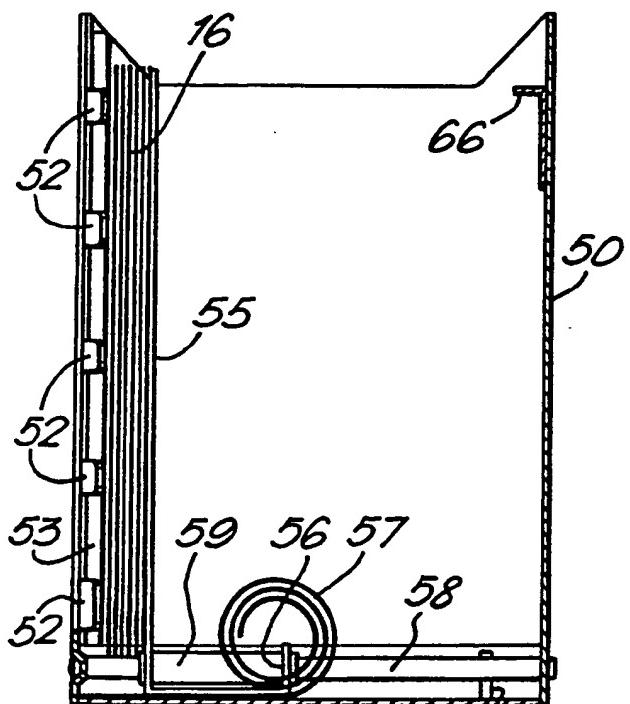
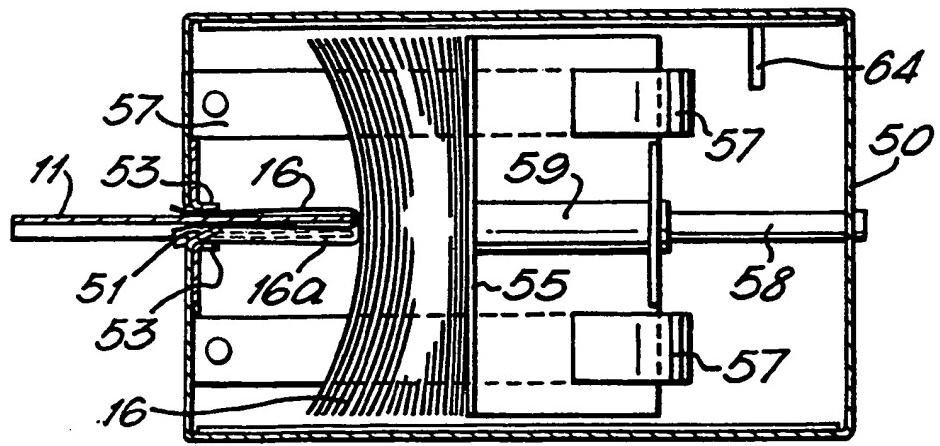


FIG. 5C.



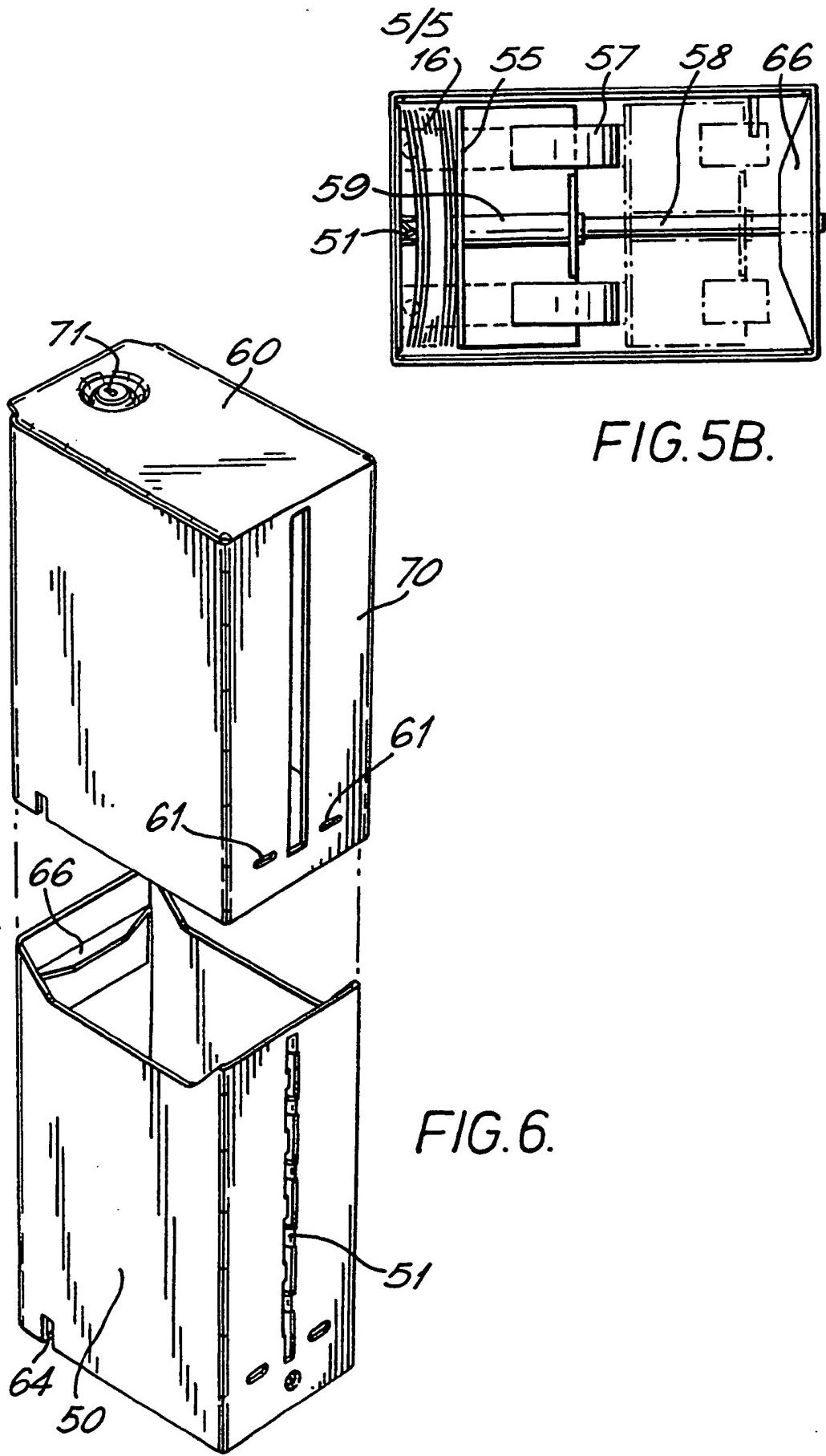


FIG.5B.

FIG.6.

BANK NOTE CASSETTE

This invention relates to apparatus for securely storing sheet material fed thereto and more particularly but not exclusively to an apparatus for storing bank notes. The apparatus can, however, be used to securely store sheet materials other than banknotes such as tickets, bank cheques, credit card payment slips or the like.

Goods purchased in a retail shop are normally paid for in cash or by credit card or bank cheque which are placed in a till. In a busy shop, the till can often contain large quantities of cash so it is common practice to empty it on a regular basis to reduce the risk of any unauthorised removal of money therefrom. Known procedures for dealing with this problem involve the cashier removing a large sum of money from the till and inserting it into a bag or other suitable container which is then removed by another member of staff and taken to a secure storage safe elsewhere in the building. The main problem with this procedure is that is normally done in full view of the customers so there is a high risk of robbery. In another known system, the till is regularly emptied into a shuttle which is transported by a vacuum system to a central safe. Yet again, this system is far from satisfactory as the money removed from the till has to be placed in the shuttle in full view of all the customers. A similar problem arises in "hole in the wall" machines which give change for banknotes. In such machines, the banknote to be changed is inserted into an opening in the machine and, if the note is accepted by the machine's note validator mechanism, a signal is generated which activates the change delivery mechanism

and the banknote is delivered to a storage container in the machine for eventual removal when the machine is emptied. Very often, these storage containers are open-topped receptacles in which the money lies on arrival therein so it is very easy for the person emptying the machine to remove some or all of the banknotes therefrom.

It is an object of the invention, therefore, to provide an apparatus for securely storing sheet material such as bank notes in such a way that they are collected in a secure storage cassette which can subsequently be removed from the apparatus and replaced with another empty cassette.

According to the invention, there is provided apparatus for securely storing sheet material comprising a housing with an entry opening to receive and admit a sheet of material to the interior thereof, a secure storage cassette for receiving and storing sheets of material admitted to the housing, said storage cassette having a tortuous opening therein through which, in use, an admitted sheet of material is pushed by a movable inserter of a cooperating configuration, the arrangement being such that when a sheet of material is admitted to the housing and it arrives in front of the tortuous opening in the cassette, the inserter moves towards said opening to fold the sheet of material and push it therethrough into the interior of the cassette.

Preferably, the inserter is positioned and adapted to fold the sheet of material in half as it pushes it through the tortuous opening into the secure storage cassette, but other folding configurations are possible.

Preferably, a space is provided between the inserter and said tortuous opening, the admitted sheet of material being arrested in said space opposite the tortuous opening. Conveniently, the inserter folds said sheet about its longitudinal axis as it pushes it into the cassette. Suitably, said space is located below the entry opening to the housing so that an admitted sheet of material can fall into said space and come to rest therein in a substantially vertical orientation.

In a preferred embodiment, a plurality of spaced tabs are located along each side of the tortuous opening in the cassette, said tabs being inclined towards each other to provide an inwardly directed V-shaped entry opening. According to a preferred feature of the invention, the inserter comprises a plate having a plurality of fingers along one edge thereof, each finger being vertically offset with respect to an adjacent finger but, alternate fingers, being coplanar with each other. Preferably the inserter is moved towards and away from the tortuous opening in the cassette by an electric motor. Conveniently, the electric motor is a DC motor and is mounted on a spring-loaded carriage, optical sensor means being provided to sense movement of said carriage and activate said motor.

In a preferred embodiment, audio or visual means are provided to indicate when the last sheet of material has been inserted into the storage cassette and the cassette is full. Conveniently, housing identification means are provided in the housing which are operable to cooperate with the storage cassette on insertion therein to identify the housing into which the cassette has been fitted. In a preferred embodiment, said

identification means comprises means which protrude from the housing and cooperate with the cassette to mark record means therein with a set of identification marks.

Conveniently, said record means comprises a card which is pierced by a set of identification fingers protruding from the housing, but any other form of identification means may be used.

The preferred storage cassette comprises an open-topped container in one wall of which the tortuous opening is located, said container having a removable cover with a slot therein to leave access to the tortuous opening in the container, the cover having a lock to secure it to the container. Preferably means are provided in the container operable to bias each sheet of material inserted into the container in a direction towards the tortuous opening.

Conveniently the storage cassette is secured to the housing by means of a lock.

A preferred embodiment of the invention will now be described, by way of example only, with reference to the accompanying drawings in which :

Figure 1 is a perspective view of an apparatus of the present invention,

Figure 2 is a front view of the apparatus shown in Figure 1 but with the storage cassette omitted,

Figure 3 is a cross-section along the lines III-III in Figure 2,

Figure 4 is an underneath view of the apparatus shown in Figures 2 and 3,

Figure 5 is a front view of the storage cassette, shown in Figure 1 but with the cover omitted,

Figure 5A is a cross section along the line V-V in Figure 5,

Figure 5B is a top view of the cassette shown in Figure 5A but with sheets of material therein,

Figure 5C is a schematic plan view showing a sheet of material being inserted into the cassette and,

Figure 6 is a perspective view showing the storage cassette of Figure 5 and its security cover.

In the following description, the apparatus will be described in terms of handling and storing sheets of material which are bank notes. It will be appreciated, however, that the sheets of material could be tickets, bank cheques, credit card slips, etc.

Referring to Figure 1, there is shown an apparatus of the present invention which comprises a housing 1 having an opening 2 in the front thereof into which a removable storage cassette 50 can be fitted. The upper region of the housing 1 is provided with a shelf 3 to receive a known electronic note validator 80.

In use, a note 16 (see Figure 3) is inserted into slot 81 at the front of the validator through which it passes to emerge from the rear thereof with its front edge located in opening 4 in the upper part of the housing 1. This opening 4 is provided with a guide surface 5 through which a wheel 6 protrudes. The wheel 6 is driven by a DC motor 9 via belt 10. A pressure plate 7 is hingedly mounted at a pivot 8 adjacent its forward edge whereby it normally exerts a downward pressure on the wheel 6. Lower portion 15 of the guide surface 5 is arranged substantially vertically and spaced from rear wall 40 of the housing (see Figure 3) to provide a space 18 between the rear wall 40 of the housing and front face 70 of the cassette when inserted therein. When the note emerges from the rear of the

note validator 80 and it arrives in the opening 4, the wheel 6 is rotating. The note 16 is drawn into the apparatus between the pressure plate 7 and the wheel 6 and falls downwardly into the space until its leading edge comes to rest on the bottom of said space. The note is now vertically positioned in said space 18 standing on its leading edge.

A note inserter 11 is located behind the wall 40 of the housing 1 and comprises a plate having a plurality of fingers 12 provided along its leading edge. It will be noted that spaces 12a are provided between the fingers of the note inserter and additionally that its cross sectional shape is tortuous in that each finger 12 and its adjacent connecting portions 12b are offset with respect to each other and alternate pairs of fingers 12 and connecting portions 12b are coplanar with each other. This novel feature of the note inserter is particularly well illustrated in Figure 2. The note inserter 11 is shaped in this way so that it can be inserted into and cooperate with a tortuous slot or opening 51 provided in the front face of the note storage cassette 50. The configuration of this opening can be clearly seen in Figure 5 to comprise a vertical slot 51 with blocking members in the form of tabs 52 provided along each of its longitudinal edges, the tabs 52 being staggered in relation to each other and the leading edge of each tab protruding into the space between two facing adjacent tabs. Instead of fixed tabs 52, pins or resilient fingers or the like can be used. Additional brushes or spines can also be provided on either side of the interior of the tortuous opening to prevent viewing of the notes in the cassette and to assist in discouraging any attempted unauthorised removal of the notes.

Referring now to Figure 2, the note inserter 11 is more clearly visible and it can be seen that the rear wall 40 of the opening 2 is provided with a slot 41 in which the note inserter 11 is located. A pair of tabs 62 protrude from the base of the rear wall 40 to locate in corresponding slots 61 (see Figure 6) at the base of the cover 60 for the cassette 50 when inserted in the opening 2. The position of the cassette 50 can be seen in chain dotted line in Figure 3 and it will be seen that its upper front edge locates against the lower portion 15 of the surface 5 whereas the lower edge locates on the tabs 62 thereby providing the space 18 between the front face 70 of the cassette and the rear wall 40 of the housing.

The note inserter 11 reciprocates from its rest position shown in Figure 3 to a second position where the fingers 12 protrude from the slot 41 in the rear wall 40 and enter the tortuous opening or slot 51 in the cassette 50. The note inserter 11 is centrally mounted on a U-shaped supporting plate 19. Bushes 34a, 34b, 35a, 35b (see Figure 4) are provided thereon so that it is slidable along rails 32, 33. A drive bracket 14 (see Figure 3) is attached to bottom 13 of the plate 19 and has an aperture therein locating a PTFE threaded bush 17 therein. A motor d.c. 20 is mounted on plate 38, the motor 20 being connected by means of a coupling 21 to a threaded rod 22 which passes through the threaded bush 17 its end remote from the motor 20 being located in bearing 23. This bearing 23 is mounted in a U-shaped bracket 24. The brackets 38 and 24 are attached to guides 25, 26 to provide a movable carriage for the motor 20, the guides 25, 26 having flanges 25a, 25b, 26a, 26b, extending therefrom to receive and slidably mount the movable carriage on rails 36 and 37. Springs 28, 29, 30 and 31 are located

between the walls of the housing 1 and the flanges 25a, 25b, 26a, 26b so that the whole motor assembly with its coupling 21, drive shaft 22 and bearing 23 is resiliently mounted on the carriage for movement with respect to the plate 19 carrying the note inserter 11. The purpose of this resiliently mounted carriage will be explained hereafter.

A lock 65 is provided adjacent the base of the opening 2 in the housing 1 and has a locking finger 63 which cooperates with aperture 64 in the cassette 50 to retain it in the opening 2 in the housing.

The housing also includes in its base known electronic control means 45 operable to cause the apparatus to function in the required operating sequence to be described hereafter. The various electrical components are mounted on a circuit board 47. Optical sensors (not shown) activate various electrical functions depending on the position of the bottom plate 13 or the motor carriage.

Figures 5 and 6 illustrate in more detail the cassette 50 which fits into the opening 2 in the housing 1. Referring first to Figure 6 it can be seen that the cassette 50 comprises an open-topped metal container having the tortuous opening 51 in its front face. Tabs 52 are provided along the opposite edges of the opening 51 to render it tortuous in shape and it is through this slot that note 16 is pushed as will be described in more detail with reference to Figure 5C. The metal container is provided with an opening 64 in its base to receive the finger 63 of the lock 65. The inside rear wall of the cassette 50 has a lip 66 protruding therefrom which is engaged by the locking finger (not shown) of lock 71 fitted to the top of cover 70 which

slides over the cassette 50 as illustrated in Figure 6. By arranging the lock 71 in this fashion to cooperate with lip 66, the cover 70 cannot be placed over the cassette 50 the wrong way round as it will only lock when the lock 71 is aligned with lip 66.

The cassette 50 includes a biassing plate 55 which is slidable along rod 58 against the pressure of coiled leaf springs 57. As can be seen from Figures 5A-5C, the biassing plate 55 is substantially L-shaped, with an upstanding lug 56 at the end of the foot of the plate. A bearing tube 59 is mounted between the biassing plate 55 and the lug 56 and rod 58 passes through the bearing tube 59. Thus, the plate 55 is slidable towards and away from the slot 51 against the action of the leaf springs 57 when the note inserter 11 pushes a note 16 into the cassette through the tortuous entry slot 51 as can be seen in Figure 5C. Because the note inserter 11 is also of tortuous configuration, it will be appreciated that as it moves towards the slot 51 in the cassette it folds the note 16 in half and the note assumes a similar configuration to the slot 51 as it is pushed through. For this reason, in Figure 5C, the upper edge of the note 16 is visible together with a first deflected portion 16a caused by the offset the portion 12b located beneath the uppermost finger 12 of the note inserter 11 (see Figure 2).

Referring now to Figure 5C, the inner edges of the slot have guide surfaces 53 extending along the whole of each edge of the slot, these guide surfaces 53 being arranged at right angles to the front face of the cassette 50 to assist in the proper guiding of the note 16 into the cassette. They also have the added advantage that they prevent the admission or entry any alien object into the interior of the cassette in a

lateral direction. Once the note 16 has been fully inserted through the slot 51 in the cassette, it opens up due to its natural resilience and is urged back towards the entry slot 51 by means of the biassing plate 55. It will be appreciated that the note inserter 11 will have to enter the slot 51 by at least half the width of the note to ensure that it is fully inserted in the cassette. On withdrawal of the note inserter 11, the stack of notes 16 is urged back towards the entry slot 51 as shown in Figure 5B. When in this position, part of the foremost note will be visible through the entry opening 51 in the cassette 50 but said note cannot be removed from the slot using, for instance, a piece of wire, because the lips 53 prevent the wire being inserted laterally into the slot and the tortuous shape of the opening means that the foremost note cannot be removed without tearing or shredding it.

The operating sequence of the apparatus just described and illustrated is as follows:

Referring to Figure 3, a note validator 80 is shown in dotted line mounted on the shelf 3. A note 16 inserted in the validator 80 will pass through a slot therein and its leading edge will emerge from the rear of the validator 80 to rest between the pressure plate 7 and the wheel 6. The wheel 6 is rotating the note 16 from the validator 80 into the housing 1. Once the trailing edge of the note 16 has left the wheel 6, the note falls into the space 18 and eventually comes to rest on the bottom 13 thereof. After a short delay of say 1-2 seconds, the electronics on the circuit board 47 send a signal to the d.c motor 20, the spindle 22 is rotated, thereby causing the support bracket 14 connected to the bracket 19 carrying the note inserter 11 to move along

the spindle 22. The fingers 12 of the note inserter 11 thus emerge from the slot 41 in the rear wall 40 of the housing to engage the note 16 positioned in the space 18, fold it in half and push it into the slot 51 in the cassette 50. Once the note 16 has been forced through the tortuous opening 51 in the cassette 50, its natural resilience causes it to spring open and be stored in the cassette in the manner already described with respect to Figure 5C. When leading edge 13a of the bottom 13 of the support plate 19 reaches an optical sensor (not shown), the sensor reverses the direction of rotation of the motor and the plate 19 returns to its rest position.

When that position is reached, another optical sensor (not shown) senses that position and switches off the d.c motor 20 ready for the next cycle.

The cycle just described is repeated each time a valid note 16 is inserted in the opening 4 and an accept signal is transmitted by the note validator 17 to the electronics 45 mounted on the circuit board 47.

The apparatus described and illustrated includes means whereby the motor 20 will be de-activated when the cassette 50 is full of notes and can accept no more. The apparatus is programmed to operate by means of its electronics 45 whereby the last note which is capable of being inserted into the cassette is pushed into it by the note inserter 11 in the manner just described. However, because the cassette is now full, the biassing plate 55 is unable to move away from the entry slot 51 any further, so the note inserter 11 meets with resistance when it reaches the maximum travel on its outward stroke and the spring loaded carriage mounting the motor 20 moves in a direction away from the

cassette 50 and trips further optical sensors (not shown) to switch off the motor 20. A signal is also issued once this movement of the motor carriage has occurred to provide a visual or audio indication that the cassette is full and the whole apparatus deactivated. The apparatus will therefore not accept any further notes until such time as the cassette 50 is changed and the electronics in the apparatus produce an appropriate signal on removal of the cassette to reset the operating cycle so that it can accept notes on replacement of the full cassette with an empty one. A substantial advantage of this arrangement is that the last note to be accepted by the note validator 17 will always end up inside the cassette 50 so there is no risk of a note being left in the space 18.

An important advantage of the apparatus of the present invention is that the cassette 50 is totally passive. In other words, it is not connected in any operable way to the housing other than by the lock 65 (for instance, electronically), so it is cheap to manufacture and the cost of additional cassettes is minimal.

CLAIMS

1. Apparatus for securely storing sheet-material comprising a housing with an entry opening to receive and admit a sheet of material to the interior thereof, a secure storage cassette for receiving and storing sheets of material admitted to the housing, said storage cassette having a tortuous opening therein through which, in use, an admitted sheet of material is pushed by a movable inserter of a cooperating configuration, the arrangement being such that when a sheet of material is admitted to the housing and it arrives in front of the tortuous opening in the cassette, the inserter moves towards said opening to fold the sheet of material and push it into the interior of the cassetts.
2. Apparatus as claimed in claim 1 wherein a space is provided between the inserter and said tortuous opening, the admitted sheet of material being arrested in said space opposite the tortuous opening, the inserter being operable to fold the sheet of material about its longitudinal axis as it pushes it into the cassette.
3. Apparatus as claimed in claim 2 wherein the space is located below the entry opening to the housing so that an admitted sheet of material can fall into said space and come to rest therein in a substantially vertical orientation.
4. Apparatus as claimed in any one of the preceding claims wherein the tortuous opening in the storage cassette has by a plurality of spaced blocking members

located along each side of the opening, inclined towards each other to provide an inwardly directed V shaped entry opening.

5. Apparatus as claimed in claim 4 wherein the inserter comprises a plate provided with a plurality of fingers along one edge, each finger being vertically offset with respect to an adjacent finger but, alternate fingers being coplanar with each other.

6. Apparatus as claimed in claim 5 wherein the inserter is moved into and out of the tortuous opening in the storage cassette by an electric motor.

7. Apparatus as claimed in claim 6 wherein the electric motor is mounted on a spring loaded carriage, optical sensor means being provided to sense movement of said carriage and activate the motor.

8. Apparatus as claimed in claim 7 wherein audio or visual means are provided to indicate when the last sheet of material has been inserted into the storage cassette and it is full.

9. Apparatus as claimed in any preceding claim wherein identification means are provided in the housing openable to cooperate with the storage cassetts on insertion therein to identify the housing into which the cassette has been fitted.

10. Apparatus as claimed in claim 9 wherein said identification means comprises means which protrude from the housing and cooperate with the cassette to mark second means located therein with a set of identification marks.

11. Apparatus as claimed in claim 10 wherein the second means comprises a card located in the storage cassette to be pierced by a set of identification fingers protruding from the housing.

12. Apparatus as claimed in any of the preceding claims wherein the storage cassette comprises an open topped container in one wall of which the tortuous opening is located, said container having a removable cover with a slot therein to leave access to the tortuous opening in the container, the cover having a lock to secure it to the container.

13. Apparatus as claimed in claim 13 wherein means are provided in the container operable to bias each sheet of material inserted in the container in a direction towards the tortuous opening.

14. Apparatus as claimed in any one of the preceding claims wherein the storage cassette is secured in the housing by means of a lock.

15. Apparatus substantially as herein described with reference to the accompanying drawings.

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